Smoking among women of reproductive age: how are states progressing toward the United States' year 2000 objective?

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Abstract

Objectives – To determine state specific trends in the prevalence of cigarette smoking among women of reproductive age (18–44 years) during 1987–1993 and to assess progress toward the year 2000 target prevalence of $\leq 12\%$.

Setting and Subjects – Telephone interviews of women aged 18–44 years in the 33 states that participated in the behavioral risk factor surveillance system each year from 1987 to 1993. The aggregate number of interviews per year ranged from 15 329 to 21 148. State sample sizes ranged from 318 to 1398 each year.

Methods – Linear trend analysis of smoking prevalence among women of reproductive age in each of the 33 states, calculated using weighted least squares regression.

Results – State prevalences for smoking among women of reproductive age ranged from 15.3 % to 33.7 % (median = 27.1 %) in 1987, compared with 14.7 % to 32.6 % (median = 23.0 %) in 1993. A statistically significant (p < 0.05) decline in smoking prevalence among women of reproductive age occurred in eight of the 33 states. Most of this decline occurred during the period 1987 to 1990; little or no decline occurred from 1990 to 1993.

Conclusions – The decline in smoking prevalence among women of reproductive age observed in many states before 1990 appears to have levelled off. If current trends continue, few if any states are likely to achieve the year 2000 objective for smoking prevalence among women of reproductive age.

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Keywords: smoking; trend; epidemiology; prevalence; prevention; reproductive aged women

Introduction

Cigarette smoking during pregnancy increases the risk of preterm delivery, miscarriage, stillbirth, low birthweight, sudden infant death syndrome, and infant mortality.[1] As well as increasing their risk of cardiovascular disease and lung cancer, women who smoke during their reproductive years also increase their risk of infertility, menstrual cycle abnormalities, and early menopause.[2] Furthermore, women who smoke while using oral contraceptives increase their risk for myocardial infarction[3] and stroke.[4]

Accordingly, the US Department of Health and Human Services has set the year 2000 target prevalence for smoking among women of reproductive age (18–44 years) at 12 %, three percentage points lower than the target for the general adult population.[5] Despite the lower target prevalence, the smoking prevalence among women of reproductive age in 1991 was higher than the smoking prevalence among the general adult female population.[6]

The prevalence of smoking among reproductive aged women varies substantially among states[7,8]; however, there have been no published reports that compare trends among states for this demographic group. In this study we report state specific trends in the prevalence of smoking among reproductive aged women in the 33 states that participated in the behavioral risk factor surveillance system (BRFSS) each year from 1987 to 1993. We also assess progress towards the year 2000 objective and describe geographical patterns in smoking prevalence.

Methods

DATA SOURCE

Data for the BRFSS are collected by state health departments in collaboration with the US Centers for Disease Control and Prevention (CDC). The system provides state specific information about risk factors for the leading causes of death among US adults. These risk factors include alcohol and tobacco use, obesity, lack of leisure time physical activity, and high blood pressure.[9]

For each year, in each participating state, an independent probability sample of households with telephones among the non-institutionalised civilian population is selected by a multistage cluster sampling design based on the Waksberg method.[10] Trained interviewers make multiple attempts to contact a household before substituting another household. After contacting a household, the interviewer randomly selects an adult 18 years of age or older for the interview. If the adult selected is not available at the time of the initial

telephone contact, the interview is conducted during a follow up telephone call. To ensure that interviews are conducted correctly, supervisors periodically monitor all interviewers.

All states use an identical core questionnaire. The telephone interviews, which last approximately 10 to 15 minutes, are conducted on a monthly basis. This allows for the analysis of trends in health behaviours by month, quarter, or year of interview. A detailed technical description of the methods used by the BRFSS has been presented elsewhere.[9]

In 1987, 33 states (including the District of Columbia) participated in the BRFSS; by 1993 the number had increased to 50. We included in the study the 33 states that participated each year from 1987 to 1993. The data were weighted by age, race, and sex to provide estimates of health behaviours representative of the adult populations residing in each state.

PREVALENCE ESTIMATION

For this analysis, we included only women aged 18 to 44 years. The number of interviews per year among women aged 18 to 44 residing in the 33 study states increased from 15 329 in 1987 to 21 148 in 1993. Annual state sample sizes ranged from 318 to 1398. We used responses to the following questions: "Have you smoked at least 100 cigarettes in your entire life?", "Do you smoke cigarettes now?", and "On average, about how many cigarettes a day do you now smoke?" A respondent who answered "yes" to the first two questions and provided an estimated number of cigarettes in response to the third was considered a current cigarette smoker. Because of the complex sample design, we used the Statistical Analysis System (SAS), version 5.18, and SESUDAAN[11] to obtain prevalence estimates and standard errors for current cigarette smoking.

TREND ANALYSIS

We calculated the linear trend during the five year study period for each state, using least squares regression. We used six month intervals – producing fourteen prevalence estimates for each state – in order to maximise the number of data points[12] while ensuring a minimum of 100 interviews per data point. Each prevalence estimate was weighted inversely to its variance.[13] We computed the slope and standard error of the slope for each linear model and determined the statistical significance of trend using a two tailed t test with twelve degrees of freedom, that is, $t > 2.179 = p < 0.05$.[14] Box plots[15] were used to visually portray trends in the distribution of state prevalences.

Results

Utah reported the lowest prevalence in each of the seven study years, whereas a variety of states reported the highest prevalences in a given year: Maine in 1987; Kentucky in 1988;

Kentucky and Rhode Island in 1989; Missouri in 1990; Tennessee in 1991; Wisconsin in 1992; and West Virginia in 1993 (table). States with the highest smoking prevalences were clustered in the midwest, whereas those with the lowest smoking prevalences were clustered west of the Mississippi river. This geographic pattern was similar in 1987 (fig 1) and 1993 (fig 2).

In 1987, the percentage of reproductive aged women who smoked cigarettes varied among states from 15.3% to 33.7% (median = 27.1%), compared with 14.7% to 32.6% (median = 23.0%) in 1993 (table). The annual change in smoking prevalence (slope) varied among states from -1.68 to $+0.43$ percentage points (median = -0.49). The middle 50% of the distribution (25th to 75th percentile) declined steadily from 1987 to 1990 but remained essentially unchanged from 1990 to 1993 (fig 3).

A statistically significant decline ($p < 0.05$) in smoking prevalence from 1987 to 1993 occurred in eight of the 33 states (table). These eight states were geographically scattered (fig 2). In no state was there a statistically significant increase in smoking prevalence.

Discussion

In 1993, the median state prevalence of smoking among women of reproductive age, 23.0%, was nearly double the year 2000 objective ($\leqslant 12\%$); in only three states was the prevalence within five percentage points of the objective. Given the lack of decline during 1990 to 1993, few, if any, states seem likely to achieve the year 2000 objective for smoking prevalence among women of reproductive age.

Data from the 1991[16] and 1992[17] national health interview surveys (NHIS) also suggest a levelling off of the decline in smoking prevalence both for the total population and for women of reproductive age. This apparent levelling off has been attributed to the following two factors: (1) intensified promotional and advertising efforts by the tobacco industry, and (2) growth in the availability and market share of inexpensive cigarettes, including generic cigarettes and other discounted brands.[16] It has also been suggested that as more smokers quit, an increasing percentage of the remaining smokers – the so-called "hard core" smokers[18] – may be less likely to quit.

The geographic pattern of states with high and low smoking prevalence among women of reproductive age – highest prevalences in the midwest and lowest prevalences west of the Mississippi river – is similar to that reported earlier.[8] Similarly, smoking quit ratios have been shown to be lowest in midwestern states and highest in states west of the Mississippi river.[19] Thus this pattern of geographical clustering appears to be quite stable.

Various factors may contribute to state to state variation in the prevalence of smoking among women of reproductive age. These potential determinants include age and race distribution[8]; indicators of socioeconomic status such as occupation, employment status,

Table   Smoking prevalence (%) among women aged 18–44 years, 1987–1993

State	1987	1988	1989	1990	1991	1992	1993	Change†	SE
Alabama	25.6	25.3	23.2	22.6	18.1	20.0	17.0	−1.46*	0.28
Arizona	27.9	24.4	25.9	20.5	21.7	18.5	22.3	−1.58*	0.54
California	20.8	19.7	20.7	17.2	17.5	17.0	18.5	−0.49	0.24
District of Columbia	28.0	20.7	24.8	18.3	20.2	17.1	15.0	−1.68*	0.41
Florida	26.6	24.9	28.5	23.9	22.0	22.9	23.7	−0.66	0.34
Georgia	23.6	23.1	22.9	21.7	19.1	16.7	19.8	−1.08*	0.28
Hawaii	22.0	23.5	20.5	19.5	18.2	18.7	19.4	−0.64*	0.27
Idaho	23.1	22.2	20.8	21.5	21.2	18.1	22.6	−0.40	0.27
Illinois	27.8	28.5	26.7	20.0	27.0	23.1	23.3	−0.74	0.48
Indiana	30.0	30.5	29.8	30.0	27.0	28.6	29.5	−0.32	0.24
Kentucky	31.8	34.7	32.0	20.6	28.8	29.0	31.7	−0.46	0.40
Maine	33.7	33.7	30.7	25.7	28.7	26.3	26.8	−1.26*	0.38
Maryland	28.6	25.1	22.3	23.5	21.2	21.9	19.3	−1.11*	0.31
Massachusetts	29.1	30.9	26.7	25.0	26.4	24.6	24.2	−0.99*	0.26
Minnesota	26.7	25.7	24.0	25.2	25.9	24.5	24.9	−0.22	0.31
Missouri	29.3	30.4	27.0	33.2	25.8	26.2	28.6	−0.43	0.52
Montana	24.4	18.4	18.5	19.4	24.6	19.6	19.7	−0.23	0.43
New Hampshire	27.6	29.3	26.5	22.3	23.8	26.0	23.0	−0.96	0.48
Nebraska	27.9	24.2	24.1	27.0	24.0	21.3	28.7	−0.07	0.47
New York	23.9	27.5	26.8	26.6	26.5	24.4	25.0	−0.02	0.75
New Mexico	16.9	22.1	21.9	23.0	17.9	19.2	20.3	+0.17	0.59
North Carolina	23.4	28.5	26.2	31.3	21.9	27.9	28.2	+0.43	0.54
North Dakota	27.3	24.9	20.7	22.6	19.4	25.1	22.3	−0.55	0.38
Ohio	29.3	32.0	28.0	30.6	25.9	24.6	30.1	−0.44	0.54
Rhode Island	27.1	29.2	32.0	29.1	27.2	23.7	26.2	−0.61	0.46
South Carolina	21.2	27.4	22.0	26.1	25.0	28.1	22.8	+0.38	0.48
South Dakota	29.6	22.2	23.2	22.4	24.0	25.1	22.1	−0.50	0.49
Tennessee	25.4	28.3	29.8	28.1	29.7	27.4	27.6	+0.20	0.34
Texas	25.4	22.7	21.9	22.4	21.5	20.1	21.4	−0.61	0.31
Utah	15.3	16.2	17.1	16.0	14.2	15.0	14.7	−0.26	0.24
Washington	23.3	24.4	26.7	21.1	24.9	23.9	22.5	−0.19	0.35
West Virginia	29.9	26.8	29.7	28.4	28.0	27.1	32.6	+0.30	0.40
Wisconsin	30.5	32.7	29.8	26.2	25.0	30.8	26.2	−0.71	0.39
Median	27.1	25.3	25.9	23.0	24.0	23.9	23.0	−0.49	0.39

† Annual percentage point change, 1987–1993, based on linear regression using six month interval prevalence estimates. Annual sample sizes for states ranged from 318 to 1398.
* Indicates statistically significant trend (p ≤ 0.05).

between states with low and high smoking prevalence, may also play a role in determining a state's rate of change in smoking prevalence.

Sociodemographic differences among states (age, race, and educational attainment) were shown not to account for state to state variation in smoking prevalence among reproductive aged women in 1989.[8] Smoking prevalence among white and black women has been shown to be similar,[8,23] further suggesting that race is not a major determinant of variation among states.

Self reported smoking status has been shown to be an accurate measure of smoking behaviour when validated by biochemical markers in several large community surveys[24,25] and in at least one large epidemiological study.[26] Nevertheless, for at least three reasons smoking prevalence in the general population may be higher than that estimated by the BRFSS. First, estimates from the current population survey, in which information is collected in person (or by proxy)[27] rather than by telephone, are generally about two percentage points higher than those from the BRFSS.[1(p281)] Second, persons who live in households that have no telephone are more likely to smoke than are persons living in households that have a telephone.[28] Third, smokers are less likely than non-smokers to respond to health surveys.[29] These factors may have biased BRFSS smoking prevalence estimates downward; however, they are less likely to have affected trends.

Although data were not available for some states, those included in the study are probably reasonably representative of all states. States from all regions of the USA are included in the analysis, and the median smoking prevalence in 1991 among all 48 states that participated in
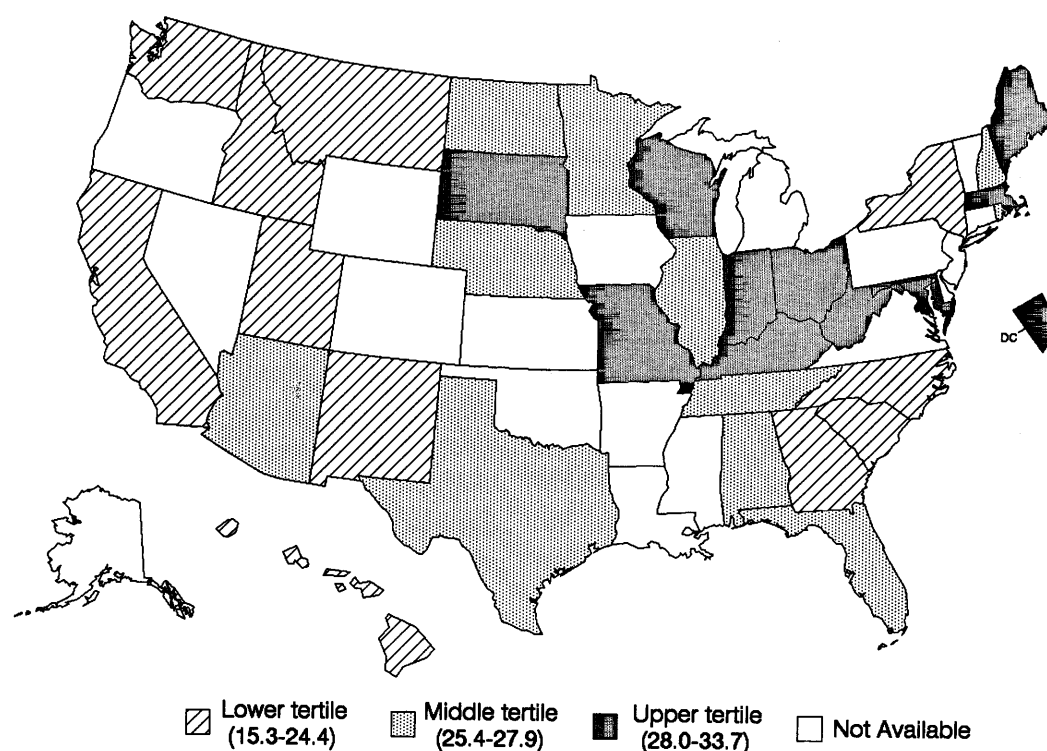
and family income[8]; differences in the intensity of cigarette advertising[1] and the effectiveness of local[20] and statewide[1,21] smoking control interventions; health insurance incentives, and deterrents for smokers[21]; and decreasing smoking initiation and increasing smoking cessation rates among more highly educated women.[22] These factors, as well as migration

Lower tertile (15.3-24.4)   Middle tertile (25.4-27.9)   Upper tertile (28.0-33.7)   Not Available

Figure 1   Smoking prevalence (%) among women aged 18–44 years, 1987

Lower tertile
(14.7-22.1)   Middle tertile
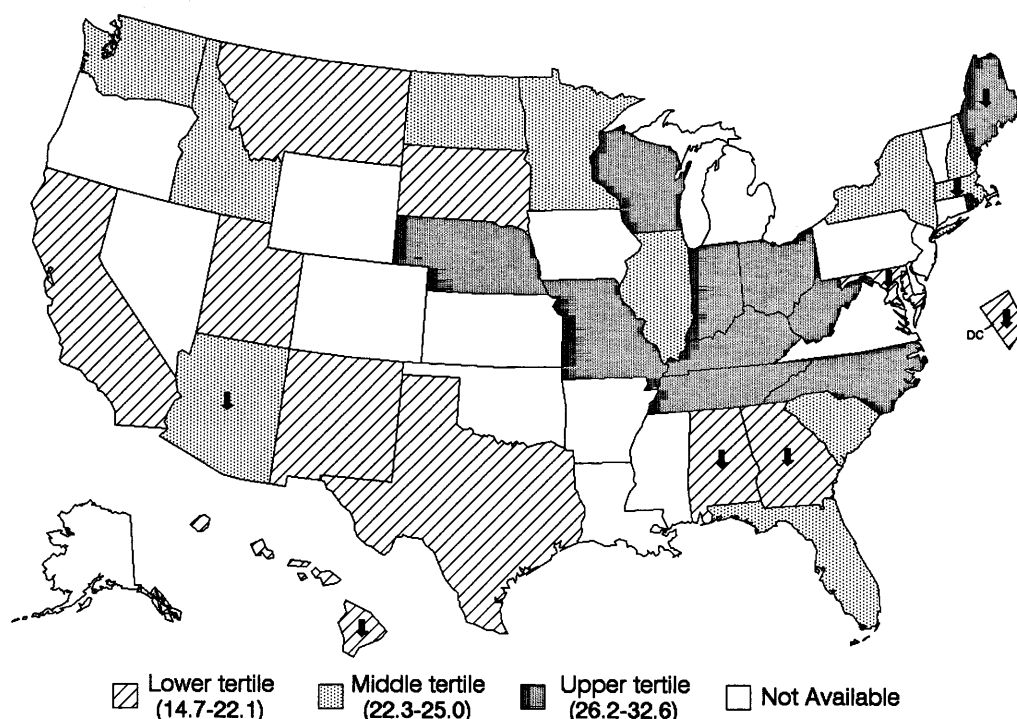(22.3-25.0)   Upper tertile
(26.2-32.6)   Not Available

Figure 2   Smoking prevalence (%) among women aged 18–44 years, 1993. The symbol ↓ indicates states with a statistically significant decline in prevalence during 1987–1993.
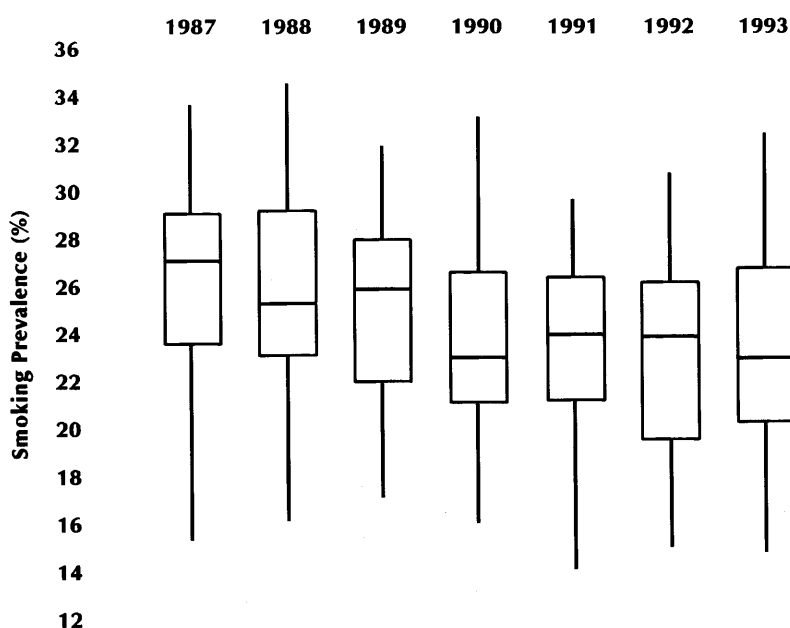

Figure 3   Box plots of the distribution of smoking prevalence (%) among women of reproductive age for the 33 states participating in the behavioral risk factor surveillance system, 1987–1993. (Plots show maximum, minimum, median, and interquartile range.)

the BRFSS that year (24.6 %) is similar to the 1991 median of the 33 states included in our study (24.0 %).[7]

Given the manifold adverse health effects of smoking among reproductive aged women, tobacco control measures should be pursued with particular vigour in this population subgroup. Health care providers and facilities that serve large numbers of reproductive aged women, especially those that women visit on multiple occasions, are in an excellent position to strengthen tobacco control efforts among this population. Repeated discussions are valu-

able both to discourage non-smokers from starting to smoke and to help smokers to quit.[30] School based, community based, and worksite tobacco control programmes have been shown to be effective,[31] and several studies have shown that smoking cessation programmes for pregnant women can be cost-effective.[32–34]

Public health officials can use data from this study on the prevalence of and trends in smoking among women of reproductive age to assess the magnitude of this problem in their state. Further research should include efforts directed at determining which public policies, legislative approaches, and clinical practices are most effective in reducing smoking prevalence among women of reproductive age.

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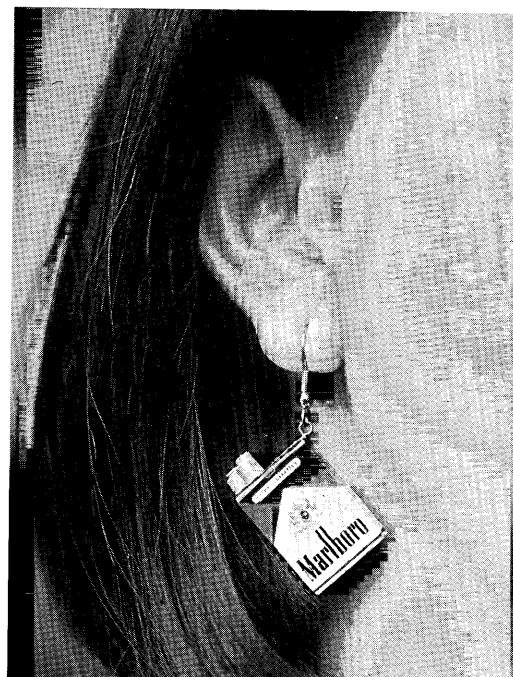
Cigarette jewellery: Camel earrings obtained for "Camel cash" coupons and Marlboro earrings from Thailand.
Sources: John Slade and Prakit Vateesatokit